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THE MADRAS CYCLONE OF MAY 2ND, 1872.

ALTHOUGH we have not been favoured by any of our Indian correspondents with notes upon the above storm, we have endeavoured to compile from various sources, a tolerably complete record of its track and principal effects. The following extracts are portions of two letters, which appeared in the *Times* of May 30th, and June 10th. The chart on page 71, together with the remarks which precede it, are compiled from various Madras and other Indian papers, and must be received subject to correction by more ample information :—

"During the months of April and May the weather in Madras is usually almost a dead calm, relieved only by the daily movement of air known when it proceeds towards the sea as the land wind, and when it comes from the sea as the sea breeze. From January to the end of May no drop of rain is expected, and when, about the middle of April, the slight N.E. wind gives way to a still slighter S.W. wind, Madras is in for its hot weather. What this means may be guessed from the fact that Madras stands in Dove's great list as the hottest place in the world. Things bore their usual form till the last day of April, when, almost without warning, heavy rain set in. On the following day, the 1st of May, rain continued, but brought with it a strong wind, which increased in violence throughout the day, until, towards evening, it became a perfect gale, and the strength of the wind did not increase faster than the intensity of the rain. Old Indians foresaw a storm, and began to ask when the ships were going out into the wide, and therefore comparatively safe, expanse of the Bay of Bengal. Madras Roads were then well furnished with shipping, except that, by a strange accident, no steamer was anchored there. Usually there are three or four. There were 18 good ships in the roads, besides 15 smaller vessels known as 'dhonies,'—vessels built in the country and manned by native crews,—holding about the same relation in size and quality to the other ships as the old collier tubs which plied between Newcastle and London did to the noble East Indiamen which used to lie off Blackwall. Some of the larger ships were owned and manned by natives also, but 12 of them were splendid English ships, two upon their first voyage.

"Many a weatherwise Englishman drove down to the beach on the evening of May-day to see for himself that the ships were gone, and returned grieved at heart. I had seen 14 ships on shore only four years before, and a year later had stood by while another brave vesssel had driven through the splendid pier. On both occasions nine out of ten of the English craft had saved themselves by slipping their cables and running out to sea. On neither occasion had things so bad a look as now, yet there every ship rode at anchor, proudly unconscious of the fate that was before it. As I turned sadly away, three-and-thirty sail tossed sleepily over the angry wave, as if they neither knew nor cared why such hoary breakers

galloped in. Yesterday I went again. It was but May 2. Only three of this great fleet were still riding there, and one of them had lost two of its masts, all the rest lay strewing the shore. But I anticipate. The gale increased as night wore on. At about midnight Mr. Pogson, the astronomer, telegraphed from the Observatory to the Marine-office that a fearful storm was near, but this the marine authorities ought to have known long before, for the glass had fallen fully half an inch. Shortly after this the ships were ordered from the shore to get ready, and at three in the morning to cut their cables and stand out to sea. It was too late. The question was not how to get to sea, but how to keep off the shore. The storm was fearful, and the surf rolled clear over everything. Wind and wave were dead set for the shore. At 3 a.m. the native craft were almost all loose, drifting steadily before the wind. One of them struck the pier just about the middle, exactly on the spot where the St. Bernard made a breach three years ago. She went clear through it, for nothing could stand such thumping, with such a hammer as a ship wielded by the mad waves. Neither ship nor pier could stand it. The former went clean through and then collapsed. She now lies a shapeless heap a few yards off. At five o'clock the cyclone was at its height, and half the English ships were adrift.

"The hurricane—for cyclone it was not, seeing that the wind never changed more than a few points—was almost as violent as ever. Few persons could withstand it. The master-attendant was driving down in a heavy carriage drawn by two horses, when the wind upset the carriage, seriously injuring the master-attendant, and leaving him senseless on the road. This is mentioned partly to show the force of the wind, and partly to explain what was seemingly great neglect on the part of the marine authorities. The surf ran at racing speed, in waves that swept over everything. The rain fell in torrents, dashing violently against all in its way. No sound could be heard but the roaring of the wind and the thuds of the leaping surf.

"As well as can be known, it appears that 30 ships in all have been wrecked. Of these 16 are visible ; the rest have gone utterly to pieces.

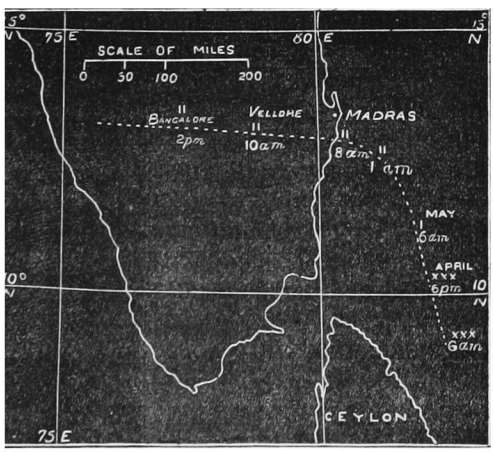
"Madras itself is like a city that has been whipped. Trees lie everywhere about the roads. Two native theatres of immense size are blown down. The ruins of poor native houses stare us in the face on all sides. There has been very little loss of life, although great loss of property."

"Since writing my former letter, the details of the storm have come in from all quarters, with results proving it to have been one of the most extraordinary atmospheric movements on record. This is especially the case with regard to the area it covered. Commencing at daybreak of the 30th of April off the coast of Ceylon, it travelled rapidly northwards, reaching Karikal early on the 1st of May, and Madras at midnight of the same day. Its straight-forward progress, therefore, averaged about 170 miles a-day, or about seven miles an hour. When off Madras, some 70 or 80 miles at sea, it suddenly turned to the left and passed, going almost due west, a little to the south of Madras. It was now on land, and by Thursday, the 2nd of May, at 10 a.m., it had reached Vellore, almost destroying that populous city. At about noon it passed over Arnee, doing great damage. By an hour or two later it was at Bangalore, but with much diminished force. At 6 p.m. of the same day it reached Nundydroog, still passing on over the Mysore plateau with even diminishing force. At Beypore, 400 miles west of Madras, it was felt as a heavy gale on the following day. The storm, therefore, travelled about 700 miles before it melted away. In breadth it was equally remarkable. It has been said that it came up the Bay of Bengal about 100 miles east of the coast line. It was, however distinctly felt at Madura on the evening of the 30th of April, although on that day the centre of the storm was passing about 220 miles away in the due east. It is not yet possible to say how far the influence of the storm extended on the other side towards Burmah, but the dismasted dhonies, or native craft, now coming in, prove that it was felt in full force far away to the east. There is, in fact, no reason to suppose that there was less width on that side than on this ; and we are therefore led to the conclusion that this great current of wind was fully 400 miles wide. These remarks will show that I was

in error in my former letter in stating that the storm was not a cyclone. It did not bear that character here, because it was but one side that passed by us.

"It has been mentioned that a fearful destruction fell upon Vellore. This famous city is situated about 80 miles from Madras, at the foot of the rock upon which stands the well-remembered fort, the scene of the Vellore mutiny. It began to rain there on Wednesday, the 1st of May, but nothing unusual occurred till after midnight, when the rain began to fall with the most astonishing violence. The water descended literally in sheets. Nothing could be seen but this terrific downpour, for it was impossible to see anything more than ten yards away. This extraordinary fall continued till about 3 o'clock in the afternoon, and in those few hours no less than 12 inches of rain fell. This has very seldom been paralleled in any part of the world. Naturally enough, the whole country was very soon placed under water, and this flowed in giant currents towards all the low-lying lands. But the district sloped towards certain tanks or artificial lakes constructed for irrigation purposes, and towards them the water poured from all sides. These tanks are not places of small area as the ordinary English use of the word would seem to imply, but are vast enclosed spaces, many times larger than the Serpentine. The rush of water was aided by the wind, which blew 'great guns.' What with wind and rain the din was deafening, and no cry for help had a chance of being heard. While the tanks were filling, the poorer mud houses in Vellore were falling, for mud walls and thatched roofs are of little use in such a rain. But any shelter was better than none, and the poor wretches to whom the hovels belonged crouched under the ruins in passive despair."

"There was a series of tanks so arranged that the lower should always catch the overflow of the upper, and thus insure that no water should run to waste until all the tanks were full and an ample supply for irrigation obtained. The uppermost of these tanks received the full brunt of the inflow, and was first opposed to danger. Soon, as wind and rain increased, the waves topped the embankment, falling on the other side. Every such wave softened the bund and lowered its top, and it was not long before the bank gave way, and the immense mass of water leapt like a bounding steed upon the lower tank. Nothing could stand such an impact. The bund gave way, and the water now doubled in volume, dashed at the third tank. Four tanks thus breached, and joining all their strength, crashed at the town," and swept a clean path through it, with a loss of probably quite 1000 lives.



Sketch Map of part of Southern India showing approximate track of centre of cyclone between April 30th and May 2nd, 1872.

At Madras the first indication of the advancing (or shall we say forming) storm was on April 28th, when the barometer began to fall.

On the 29th and 30th it was still falling, and there was a heavy and increasing surf, but very little wind. On May 1st the barometer was still falling, and the sea was so high that there was no communication with the shipping; in the afternoon the barometer (reduced to sea level) was 29·54, after midnight it fell more rapidly and at 8.30 a.m. on May 2nd was only 29·288 in., being more than half an inch below its usual reading in May.

The wind at this period of the year is generally light, from the S. but on the 29th it was E., on 30th N.E., and on May 1st N. Its average velocity during the preceding fortnight had been 8 miles an hour, but it reached 15 at 5 a.m. on May 1st, and 20 at noon, moderating to 15 at sunset; it rose again afterwards, was 25 at midnight, and until 3 a.m. remained with that velocity from the N.; at 5 a.m. May 2nd it veered to N.N.E. and was blowing 40 miles an hour, and between 8 and 9 a.m. (simultaneously with the lowest barometric reading) it reached 53 miles per hour from N.E., subsiding by 9.30 a.m. to 40 miles an hour from due E. The total rainfall during the period was 5·75 inches.

We have no desire to be precipitate in condemning without hearing the defence of, those responsible for the immense loss of life and property at Madras, but we can hardly imagine what the defence can be. Even 24 hours' warning should surely in the beginning of May, have told anyone what was to be expected in the Bay of Bengal; but instead of 24 hours there had been at least three days, during which the barometer had been falling, and the surf rising.

ANOTHER METEOROLOGICAL CONGRESS.

(Continued from page 55.)

Thermometer Readings.—In this chapter Dr. Ballot touches on such a variety of questions that if we were to remark upon them all as fully as they deserve, this chapter alone would more than fill all the space we can spare for the remainder of his *Suggestions*. We must, therefore, confine ourselves to a few words on such points as seem of the greatest importance, and on those upon which difference of opinion may arise. Dr. Ballot calls attention to the extraordinary opportunity afforded by the Mont Cenis tunnel for ascertaining temperatures in places separated by thick strata from the surface. We may just remark that this opportunity has been seized and utilized by the Underground Temperature Committee of the British Association, the temperature in the wall of the tunnel is about 85°, but we do not consider that temperatures obtained under conical elevations are comparable with those of deep borings in level tracts of country. The next point claiming notice is the suggestion that all thermometers should be aspirated; we admit the irregularity of reading caused by varying wind force, but are decidedly opposed to universal aspiration for several reasons: (1) Because it would be troublesome, cumbrous, and costly, to provide all the four thermometers (dry, wet, maximum, and minimum,) with

aspirating tubes, and clearly if one is to be aspirated all should be; (2) because it would be extremely difficult, if not impracticable, to aspirate the grass minimum, and yet it would not be comparable with the air minimum unless it was aspirated; (3) because we believe that the draught at different observatories could not be kept uniform, and that for that reason, as well as on account of the varying states of the tubes, the aspirated thermometers would be under conditions quite as diverse as if they were placed on stands properly and uniformly constructed without any aspirating arrangement whatever.

Psychrometer Readings.—Dr. Ballot recommends the psychrometer, or as we should call it, hygrometer, of Prof. von Baumhauer, which he fully describes. But while we quite agree with him as to the inaccuracies of the ordinary dry and wet bulb thermometers, we do not share his anticipations of the superiority of Prof. von Baumhauer's instrument. Has it ever been worked for a whole year uninterruptedly? Has any one compared its results with those of a Regnault, Daniell, or August's psychrometer?

Rain Gauges.—Dr. Ballot does us the honour of recommending the rules of English observers in every respect but one, viz., that he has an inclination for measuring the amount of rain at night instead of in the morning. There are three reasons why we cannot agree to this suggestion: (1) In a hilly country like the British Isles, it is necessary to have gauges on the mountain tops, and in many places far from human habitations, these could not be visited at night, and therefore would not give results comparable with those at home stations if the change were made; (2) evening observations must often be made by artificial light, and are, therefore, less likely to be accurate; (3) by actual investigation we found that more than four-fifths of the British observers measured in the morning, and we believe that we are correct in saying that with quite one-third of them a night observation is out of the question.

Atmometer.—In the matter of evaporation Dr. Ballot is apparently no nearer a practical method of observation than we are in this country; he, however, has evidently come to the same conclusion as ourselves respecting the uselessness of the evaporators hitherto used.

Anemometer.—The only remark calling for special notice is—

"I think it superfluous to inquire, whether the wind has a horizontal direction; so near the surface of the earth it must have."

What will Mr. Stow say to this?

Observations of Clouds.—The special point of this chapter is the enforcement of the desirability of more frequent observation of the height of clouds, as well as of their direction. Dr. Ballot does not seem to be aware of the cloud mirror of Mr. Goddard, which is extremely useful for the latter purpose. We are glad to find that a scale of 0 to 10 for the amount of cloud would meet Dr. Ballot's support; it is true that he desires higher numbers for denser clouds, but we doubt if he would not yield this point.

Actinometer.—Our author does not specify any one form of instru-

ment either actinometer or pyrheliometer, but he most reasonably urges the importance of continuous pyrheliometric records in "regions blessed by an ever bright sky." The concluding chapters on the *Aspect of the Sky*, *Atmospheric Electricity*, and *Observations at Sea*, like so much of the previous matter, require at our hands nothing but the expression of warm approval.

We have heard nothing definite as to the date of meeting of the proposed congress, but whenever it may held Dr. Ballot's *Suggestions* will render its discussions systematic, and keep them on points of importance. And even should the fulfilment of the proposal be long postponed, his pamphlet will not prove ephemeral, but a storehouse of *Suggestions* for years to come.

REVIEWS.

Meteorological Tables, &c. 1871. [Reprinted from No. XIII. of the Journal of the Royal Institution of Cornwall, 1871.] 8vo., 11 pp. Truro: Netherton.

Meteorology of West Cornwall and Scilly, 1871. [Reprinted from the Thirty-Ninth Annual Report of the Royal Cornwall Polytechnic Society.] 8vo., 20 pp., and one plate. Falmouth: Tregaskis.

THESE papers, jointly, give very full information respecting the meteorology of 1871 in Cornwall, returns being given from Altarnum, Bodmin, Newquay, St. Agnes, Truro, Helston, Falmouth, and the Isles of Scilly. We regret to find that neither Dr. Barham nor Mr. Dymond have succeeded in obtaining observations from Tresco Abbey for last year; in meteorology continuity of observation is all important, and a station which has afforded useful results for several years should not be allowed to drop out without any notice. The solar halo on April 5th, 1871, of which engravings and copious notices appeared in our last volume, is thus referred to:—"On 5th there was a remarkable solar halo, discussed by Dr. Jago in this number of Journal." We have not seen Dr. Jago's discussion, and if it throws any fresh light upon the subject we should be happy to bring it before our readers.

We are glad to find that Falmouth is once more provided with a good rain gauge; it is greatly to be regretted that Mr. Squire's observations were ever interrupted.

In the second pamphlet on our list we are inclined to think that Tables IV. and V., which must have cost Mr. Dymond a large amount of trouble, are uninstructive. They have been formed from the records of the Falmouth barograph, and show the hour of the civil day at which the pressure was greatest, and that at which it was least. Now, a moment's reflection will show that (with the irregular changes of the barometer which occur in these islands, and which as a rule continue in one direction for two or three consecutive days,) the maximum and minimum will of necessity occur chiefly at the time of separation between any two days, whatever that time may be, whether noon or midnight, or any other hour. The hour of midnight having been

selected, the results detailed in the following paragraph are just what might have been anticipated, but we fail to see their utility :—

"Tables 4 and 5, showing the hours of maximum and minimum pressure at Falmouth exhibit results very similar to those of last year. The maximum pressure (Table 4) occurred at 1 a.m. on 127 days, and at midnight on 81 days ; in 1870 the figures were 114 and 94. The middle of the night is again shown to be the period of highest pressure, and the secondary period of high pressure about 11 a.m. is also, as it was last year, plainly visible in the table. On only 10 days was the maximum pressure reached between the hours of 3 and 8 in the morning or afternoon. The minimum pressure (Table 5) was recorded 80 times at 1 a.m., and 102 times at midnight ; in 1870 these figures were 67 and 100. The secondary low pressure period in the afternoon will be observed, with a similar tendency to that noticed last year to be earlier in the afternoon in winter than in summer."

Having expressed our opinion of these tables, we have now much pleasure in turning to those which follow them, and saying that they are equal to any that we receive from any part of the country. The large folding plate of barometric and wind curves is also very clearly and well done.

Results of Meteorological Observations made at the Royal Observatory, Cape of Good Hope. Chiefly under the superintendence of Sir THOMAS MACLEAR, K.T., F.R.S., &c. Discussed and printed under the superintendence of EDWARD JAMES STONE, M.A., F.R.S., &c., H.M. Astronomer at the Cape. 8vo., cloth, 33 pp., and folding plate. Cape Town : Solomon and Sons.

IN the "First number of Meteorological Papers published by authority of the Board of Trade," Admiral FitzRoy reprinted a paper by Sir Thomas Maclear, entitled "Results from Meteorological Observations made at the Royal Observatory, Cape of Good Hope, between January, 1842, and January, 1856." It appears somewhat strange that in the work before us Mr. Stone makes no reference to the above-quoted work, of which, in *some respects*, his may be considered an extended edition. The two works are, however, quite different in style of composition and treatment, Mr. Stone's being (if we may so describe it) the more mathematically toned of the two, and drawn up in a form much resembling that adopted by the late Manuel Johnson, for the Radcliffe Observations. The introduction enters very fully into the question of the probable errors of the thermometers employed during the last thirty years, and this is not to be wondered at when we find such statements as this :—

"The following are the deduced corrections for the principal thermometers :—

1870. *December.*

Dollond	Adie.	Negretti. (No. 752.)	Casella. (Nos. 9685 and 9679.)	Casella. (No. 10146.)	Jones.	Robinson.
—0°·62	—0°·87	—0°·76	—0°·36	+0°·17	—0°·54	—0°·87

The Regnault standard had nearly the same index error as Adie ; whilst in 1852 the readings of these two* thermometers differed by nearly 0°·4.

* In the pamphlet the word "the" is printed where we have inserted the word "two."

It is unnecessary to inquire who was responsible for sending out thermometers which were liable to such a great change in their zero points; but we do hope that our colonial observatories will no longer be provided with "thermometers with large spherical bulbs and tubes of considerable interior bore." Mr. Stone has, however, adopted the best course in saying that—

"It is my intention to have the zeros of our standard thermometers independently determined annually, and the index errors of the thermometers in use then determined by a comparison with these standards."

It is rather singular that neither Sir Thomas Maclear nor Mr. Stone have stated the position of the rain gauge either with respect to surrounding objects, or to height above ground, or sea. This omission seriously lessens the value of the table of monthly rainfall, which is complete for thirty consecutive years. The mean annual amount is 24·10 in., and the range from 18·67 in. in 1865 to 36·72 in. in 1859, the former being 22½ per cent. below, and the latter 52½ per cent. above the mean of the whole period. The mean annual temperature is about 61°·3, and the mean annual pressure 30·07. The following is an abstract of the results:—

Month.	Barometer corrected and reduced to 32° at sea level.	Mean Temp. in Shade.	Elastic Force of Vapour.	Humidity.	Rain.	Cloud.	Wind. Mean hourly velocity.
	in.	°	in.		in.	(0—10)	miles.
January	29·966	69·2	·457	67	·72	2·8	14
February.....	29·963	68·5	·466	68	·67	3·2	14
March	30·002	66·0	·436	69	·78	3·3	12
April	30·053	61·7	·410	74	1·74	4·0	9
May.....	30·104	57·7	·373	80	3·64	5·2	8
June	30·158	55·1	·350	81	4·65	5·2	8
July.....	30·199	54·2	·333	80	3·47	4·6	8
August	30·172	55·7	·345	80	3·06	4·7	9
September ...	30·134	57·1	·355	77	2·13	4·9	10
October	30·079	60·2	·378	73	1·58	4·9	12
November ...	30·029	63·3	·401	69	1·06	4·0	13
December ...	29·987	67·1	·434	67	·60	3·1	14
Means&Totals	30·070	61·3	·395	74	24·10	4·2	11

Barnstaple Literary and Scientific Institution Twenty Seventh Annual Report. 12mo., 14 pp. Barnstaple: Knill.

CALLS for no special notice except that in the meteorological table the mean amount of cloud is very small, 3·6 is the annual mean, and in the most cloudy month it is only 5·8. This may arise from underestimation on the part of the observer, but we are rather inclined to consider it a probable characteristic of our western shores, inconsistent though it at first sight appears with their unquestionably heavy rainfall.

Currents and Surface Temperature of the N. Atlantic Ocean from the Equator to Latitude 40° *N. for each month of the year, with a General Current Chart.* [Published by the authority of the Meteorological Committee.] 4to., 48 pp., 13 plates. Stanford.

THERE used to be a tolerably clear boundary between the duties of the Hydrographical Office of the Admiralty and those of the Meteorological Office, but it now seems so often crossed in both directions, that a fusion of the two offices would never surprise us, and might very possibly be beneficial. We have heard it stoutly maintained (and it is reported that even the hydrographer concurs in the opinion) that thermometers for taking the temperature of the deep sea are *not meteorological instruments*, but are hydrographical ones. And now we have from the Meteorological Committee a series of charts of oceanic currents, which surely are not so strictly meteorological as hydrographical. The fact is it is impossible to draw a line between the two branches of investigation which shall not be prejudicial to both, and it is too great a demand on any one's patience to be told that the temperature of the surface of the sea belongs to one department and that of the water below the surface to another.

The work before us has been a long time in preparation; it was started by Admiral FitzRoy a few years after the office was established, and it was partially published in 1859. Two years afterwards the great work, "*Onderzoekingen met den Zeethermometer*," was published by Dr. Buijs Ballot; many of the results in it were available for incorporation with the English work, and have therefore been converted into English measures and utilized in the present publication. The *general* consistency of the values plotted on the maps (except where the currents are very feeble) seems to indicate that Admiral FitzRoy's opinion, that faulty observations would neutralize each other, was correct, and that from amid the errors so frequent in the logs Mr. Strachan has contrived to elicit a large store of valuable facts. The merely nominal price at which the happy circumstances of the Meteorological Committee enable them to sell the publication, places it at once within the reach of all those of our readers who wish to trace the phenomena of our climate to their frequent birthplace over the blue waters of the Mexican Gulf or amid the tangled forests of the Sargasso Sea.

Report of the Rugby School Natural History Society for the year 1871. 8vo., 68 pp., 5 plates. Rugby: W. Billington.

THIS report is quite equal to, if it does not surpass, the one which we had the pleasure of noticing last year. It contains several capital papers by present members of the school, which reflect great credit on all concerned. We quote a meteorological one verbatim, omitting only some paragraphs explanatory of the mode of plotting the observations adopted at Rugby :—

E. Burchardt, (member,) read the following Paper on "*The Cold Week in May.*"

"It is a curious fact that the week extending from the 8th to the 15th of May is sure to be colder than the one before or after it. Many scientific men have observed this, and all have fixed the date of this fall of temperature at about the same part of the month; namely, somewhere between the 8th and the 15th; the greatest cold generally occurring on the 11th. But though it was left for science to fix by observations the exact date of this, we have abundant proof in the proverbs of several countries that it was long ago observed and very generally established as a fact; and in these cases the evidence of proverbs is often very valuable, as they are often founded on long and general observation. The Scotch have a saying,

'Ne'er cast a clout
Till May be out.'

The French say, 'In the middle of May comes the tail of winter.' The Germans have a proverb to exactly the same effect; but they also have one which runs, 'He that shears his sheep before Servatius' day loves his wool more than his sheep.' Now Servatius' day falls on the 13th of May, and it is interesting to find that he and the other three saints, whose festival days run from the 11th to the 14th, are called in some parts of Germany and Holland 'Eisheiligen,' or 'Eismänner,' that is, frost saints or frostmen, because they are believed to bring cold with them. There are also in Italy several proverbs relating to this cold week in May, but I have quoted enough to show that it has been observed so long as to pass into a common saying, not only in northern latitudes, but even as far south as Venice and Milan.

"When Captain McClintock was in the Arctic sea, searching for Sir John Franklin, he noticed that this fall of temperature took place in the extreme north also. In his 'Journal of the Search for Sir John Franklin,' this is an entry: 'May 10th, 1858. On the morning of the 8th we left Holsteinborg with a pleasant land wind and bright weather. When 15 miles off shore we were stopped by ice formed in the night, the thermometer having fallen to 12°.' But on the 14th, 'Summer has suddenly burst upon us, thermometer up to 40°.'

"On May 16th, the year after, he says, 'We have not had a single clear day since the beginning of the month. Temperature at zero.'

"The average temperature of May exceeds that of April by about 7°. June exceeds May by 6½° in England. Between no other two consecutive months does the average temperature differ so greatly, except between October and November, when it is 7°, and September and October, when it is 6°. Since then the average temperature of May is so much above that of April, the thermometer ought to rise during May. And so it does, excepting the week from the 8th to the 15th, in which it invariably falls.

* * * * * *

"The cause of the sudden cold in May is some body that comes between us and the sun, and so shuts off its light and heat from us. As it cannot be seen with a telescope, it must be a cloud of small bodies, not a single one. It must be moving, or else it would soon be drawn into the sun by attraction. Its orbit cannot be in the same plane as ours, or else it would always be between us and the sun. It is, therefore, inclined to our orbit, crossing it at the part we are on the 11th of May. But, to cause a cold week every May, it would have to reach that part of its orbit which crosses ours on at the exact time when we reach that part of our orbit which it crosses.

"And as this would be a most unnsual coincidence, it must be *always* crossing that part of our orbit. The only solution is, that it must be a ring of small bodies, moving in an orbit like the earth and planets. A ring turning round the sun, as the tire of a wheel round its axle.

"But, if this is the case, why do we not have one week in November colder than the others? for the earth would reach in November that part of its orbit opposite to that which it occupies in May, and the ring would again cross between us and the sun. The reason is that this time it crosses our orbit outside, being looped into it, so as to pass inside it between us and the sun one time, and outside, so as to have us between the sun and it at the other time.

"And though we have no cold week in November, as we have in May, we *have* showers of meteors on the 14th. And these meteors are now known to be the bodies which obscure the sun in May, and which cross our orbit again in November. In 1866 these November meteors were seen very beautifully, in far greater number than in other years. The reason for this is that the ring of meteors is thicker in some parts than others, and in that year we broke through the thickest part of it. The period in which these meteors perform one revolution is 33¼ years.

"This is the probable cause of the cold week in May. But there is one thing still wanting. These meteors have never been *seen* crossing the sun. Although everything tends to prove that they *do* cross the sun in May, they have never yet been seen. This is easily accounted for when we remember that, supposing them to be the same as the November meteors, they are very small. And a cloud of small bodies crossing the sun would be detected only by its power of shutting off the light and heat from us, and throwing us into its shadow. Still it would be more satisfactory if it had been seen. Therefore every May astronomers are on the look out for it, but, so far, unsuccessfully.

"Not long ago, Herschel saw, in India, some objects, visible only with a telescope, crossing the sun, and darkening it. They moved steadily across in great numbers, all going one way, except one, which suddenly turned off at right angles to the rest. As these bodies seemed to be exactly what he was looking for, except that one which turned away from the path of the rest, he naturally thought that he had seen the bodies which cause the cold weather in May. But, with many others who were exulting over this great discovery, he was to be disappointed; for shortly afterwards he found that what he had seen was a large swarm of locusts flying at a great height above the earth, which afterwards settled in the north of India. And so this cause of the cold week, although known to exist, still remains to be actually seen in the act of shutting out the light of the sun from us."

BOOKS RECEIVED.

Silver's Handbook to South Africa. With Preface by H. W. BATES. Small 8vo., 2s.

Quarterly Return to March 31st, 1872, of Births, Deaths, Marriages, and Meteorology in Scotland.

Barnstaple Literary and Scientific Institution. Twenty-seventh Annual Report.

A Key to the Seasons and Weather; the result of Forty-two Years' Observations. By JAMES WYATT, F.G.S. 8vo., cloth. Arthur Hall and Co.

Detailed and Mean Meteorological Results at Toronto, for the Year 1871. By G. T. KINGSTON, M.A. 8vo.

Summary of Rain and Melted Snow for the Summer and Autumn Quarters of 1871, *from Observations at* 74 *Stations in Canada.* Compiled at the Magnetic Observatory, Toronto, by G. T. KINGSTON, M.A.

Results of Meteorological Observations made at the Royal Observatory, Cape of Good Hope. By Sir T. MACLEAR. Discussed by E. J. STONE, M.A., F.R.S., H.M. Astronomer at the Cape. Large 8vo., cloth.

Results of the Magnetical and Meteorological Observations made at the Royal Observatory, Greenwich, 1870. 4to.

THE THUNDERSTORM OF JUNE 2ND.

To the Editor of the Meteorological Magazine.

SIR,—A very violent thunderstorm passed over this neighbourhood last evening. Distant thunder was first heard in S.W. at 5.45 p.m. A tremendous fall of rain commenced at 6.20, and continued till 6.50 p.m, when the amount in the gauge was 0·78 in. No thunder was heard from 6.15 to 6.40, when there was a terrific flash of lightning right overhead, and from this time till 7.30 the lightning was very frequent and vivid, and the thunder incessant. Very little rain fell after 7 p.m.; distant thunder continued in N.E. till 8.15 p.m.

Yours truly,

Winchmore Hill, 3rd June, 1872. THOS. PAULIN.

THE THUNDERSTORM OF MAY 31ST.

To the Editor of the Meteorological Magazine.

SIR,—Richmond was visited on Friday last, May 31st, by an unusually heavy storm of rain and hail. The storm began about 5.20 p.m., and lasted twenty minutes. The amount of rain collected by my gauge during that time measured 0·60. This storm was followed at 6.50 p.m., by another sharp shower of only a few minutes' duration, raising the fall of twenty-four hours to 0·63.

The direction of the storm-cloud was W.N.W.; the atmosphere was calm, and only one flash of lightning was observed.

After the storm a gravel path here was thickly strewed with the leaves of a Wisteria, trained up the north side of the house, which had been cut off by the hail.—Yours truly.

EDWD. MAWLEY.

Halford House, Richmond, S.W., June 5th, 1872.

WATERSPOUT AT STEYNING, SUSSEX.

To the Editor of the Meteorological Magazine.

SIR,—Though much weakened by illness, I must send you an account of a water-spout that burst on the hill about a mile S.W. of Steyning, at 1 p.m. on Monday, the 3rd inst., with lightning and thunder.

It was observed by many persons in the neighbourhood, and is described as a column tapering to the middle from top and bottom. But a man leaving the hill with a waggon-load of flints was caught in it, and so frightened was he by the body of water that fell, that he left his horses to themselves, and took refuge under his waggon. Here the rainfall was not very heavy—only 0·31 inch being registered for the 24 hours ending at 9 a.m. on the 4th inst. The first lightning was, however, very close, being instantly followed by an alarming crash of thunder. The water-spout appears to have broken up into heavy rain on leaving the high ground.

I did not see it myself, but was witness of the previous gathering of the clouds, which illustrates the truth of Mr. Parnell's theory. Many detached cumuli had continued drawing up from the N.W., only discharging rain or hail when in combination with cloud of a higher stratum. Three such towering masses were seen to hang for some time over the hills, and to gather blackness from a lower layer of scud which boiled up from the air beneath, and was agitated in a S.W. current across the line of the chief current. Almost at the same moment there appeared a third layer of (cirro-stratus) cloud in a still higher region, also moving in a S.W. current. The rain and hail at once commenced falling from this, and soon amalgamated the moving masses into a huge rain-cloud, driven by a W.S.W. current, and the storm then burst with increased violence in the S.W., whence it drew gradually to the S.E., a carter being struck down and temporarily stunned by lightning at Hangleton, near Brighton.

I remain, yours faithfully,

HUGH INGRAM.

Steyning, Sussex, 11th June, 1872.

MAY, 1872.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1860–5	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg.	Date.	No. of Nights below 32° In shade	On grass.
			inches	inches.	in.								
I.	ENGLAND.	Camden Town	3·05	+ ·65	·74	13	18	75·9	27	33·2	20	0	2
II.		Maidstone (Linton Park)	4·35	+ 2·11	1·11	13	18	79·0	29	29·0	12	4	...
,,		Selborne (The Wakes)	3·40	+ ·92	·53	13	20	70·0	27*	28·0	20	3	5
III.		Hitchen	3·01	+ 1·08	·62	17	18	69·0	27	31·0	18‖	3	...
,,		Banbury	1·11	— 1·11	·26	13	17	69·5	29	29·0	19	2	...
IV.		Bury St. Edmunds (Culford)	2·53	+ ·37	·53	18	14	73·0	27	30·0	11**	5	9
V.		Bridport	1·88	— ·15	·70	13	17	69·0	27	29·0	19	5	...
,,		Barnstaple	1·93	— ·51	·36	6	11	68·5	2	35·0	12	0	...
,,		Bodmin	3·14	+ ·68	·53	23	19	66·0	27	36·0	19	0	2
VI.		Cirencester	2·09	— ·19	·48	7	21	...	...	...	...	...	...
,,		Shiffnal (Haughton Hall)	2·06	— ·20	·43	15	17	69·0	27	30·0	19‡‡	2	...
,,		Tenbury (Orleton)	1·96	— ·92	·33	15	18	72·7	27	29·6	19	2	7
VII.		Leicester (Wigston)	2·13	+ ·01	·40	13	16	72·0	1	29·0	18	2	...
,,		Boston	1·74	— ·20	·37	9	16	72·1	29	33·0	19	0	5
,,		Grimsby (Killingholme)	1·36	..	·29	11	16	70·0	27	31·0	11	1	...
,,		Derby	1·63	— ·53	·30	7	16	71·0	27	32·0	19‡‡	2	...
VIII.		Manchester	2·15	— ·51	·46	8	19	69·5	29	31·0	20	1	3
IX.		York	1·02	— ·93	·32	11	9	67·5	1	32·0	19	1	...
,,		Skipton (Arncliffe)	3·94	+ ·59	·90	4	17	...	...	...	...	...	...
X.		North Shields	1·96	— ·68	·30	7	21	67·0	1	34·2	20	0	1
,,		Borrowdale (Seathwaite)	9·54	·00	2·39	3	19	...	...	...	...	...	...
XI.	WALES.	Cardiff (Ely)	2·18	— ·42	·72	8	12	...	...	...	...	...	...
,,		Haverfordwest	2·30	— ·42	·90	20	13	67·0	27	33·0	22	0	5
,,		Rhayader (Cefnfaes)	...	...	...	...	...	...	...	...	...	...	...
,,		Llandudno	2·02	— ·36	·33	11	17	68·2	26	35·3	20	0	...
XII.	SCOTLAND.	Dumfries	3·29	+ ·90	·49	6	20	65·0	26	31·0	18‖	2	...
,,		Hawick (Silverbut Hall)	3·66	...	·45	7	25	...	...	...	...	...	...
XIV.		Ayr (Auchendrane House)	3·10	— ·01	·57	3	20	61·0	26†	29·0	19	3	6
XV.		Castle Toward	3·79	+ ·40	·60	15	22	58·0	28	32·0	...	...	...
XVI.		Leven (Nookton)	2·92	+ ·92	·56	14	22	66·0	25‡	32·0	18	1	12
,,		Stirling (Deanston)	2·99	+ ·34	·68	14	23	66·0	25	28·0	19	6	11
,,		Logierait	2·40	...	·57	14	12	70·0	26	30·0	18	...	...
XVII.		Ballater	..	...	...	...	...	...	...	..	...	...	..
,,		Aberdeen	3·76	...	·78	14	24	67·2	26	34·1	20	0	13
XVIII		Inverness (Culloden)	3·63	...	·87	17	20	58·5	29	35·9	19	0	3
,,		Portree	5·66	+ ·01	·96	28	28	...	...	...	...	...	...
,,		Loch Broom	3·91	...	·45	11	25	...	...	...	...	...	...
XIX.		Helmsdale	1·43	...	·17	3, 19	20	...	...	...	...	...	...
,,		Sandwick	1·69	— ·57	·26	19	19	61·0	1	34·3	11	0	14
XX.	IRELAND.	Cork	1·50	...	·59	19	14	...	...	...	...	..	...
,,		Waterford	1·41	— ·84	·21	21	20	66·0	27§	36·0	12	0	...
,,		Killaloe	2·45	— ·73	·40	6	19	72·0	28	29·0	19	2	4
XXI.		Portarlington	1·92	— 1·28	·26	8	27	65·5	26	31·5	18	1	...
,,		Monkstown	1·67	— ·24	·29	15	16	71·6	26	28·0	20	2	...
XXII.		Galway	2·30	...	·30	2	21	64·0	25‡	33·0	19	0	...
,,		Bunninadden (Doo Castle)	2·43	...	·37	6	20	61·0	14¶	28·0	12	2	...
XXIII		Bawnboy (Owendoon)	...	...	.	...	...	...	...	...	..	..	...
,,		Waringstown	2·61	...	·45	7	22	70·0	16	31·0	19	1	8
,,		Strabane (Leckpatrick)	2·52	..	·43	3	27	...	...	...	...	...	...

*And 28, 29. †And 27. ‡And 26. §And 28. ¶And 16. ‖And 19. **And 18. ‡‡And 20.
+ Shows that the fall was above the average ; —that it was below it.

METEOROLOGICAL NOTES ON MAY.

ABBREVIATIONS.—Bar for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

LINTON PARK.—Excepting the first two and last seven days, the whole of the month has been wet, cold, and ungenial, with frosts and ice nearly a quarter of an inch thick on the 12th, and ice again (though thinner) on the 20th. H, S, and sleet frequent. T, mostly distant, on 8th, 9th, 24th, and 31st. Winds principally from the S.W. and W., but on the two wettest days, the 13th and 18th, when 1·11 in. and 0·98 in. respectively fell, the wind was due N., verifying the popular idea that when R does accompany a wind from that quarter, it is a heavy one. Bar. mostly unsteady. The cold, ungenial weather has been very destructive to the fruit crop, and vegetation, which was early at the beginning of the month, is late at the end of it, grass alone being in a forward state.

SELBORNE.—Prevailing winds first and last week S.W., middle N. and N.E. Windy with hail in afternoon on 4th and 5th; violent hailstorm with T at 11 a.m. T S with H and R in afternoon of 7th. Repeated hailstorms on 8th, with T S at 4 p.m. and frequent hail showers on the 9th. Remarkable change of temperature between the 17th, when the min. was 47°·5, and the 20th, when it was 28°·0. Potatoes cut by the frost on the 20th.

BANBURY.—High wind on the 3rd, H on the 5th, 7th, and 23rd. Ball snow on 11th, T on 8th and 15th.

CULFORD.—Several slight frosts during the month, which has been somewhat cold for May, the mean temp. being below that of 1871. Polar winds prevailed during 13 days. Min of month, 30°, on 11th and 18th, and 34° on night of 31st, causing frost on the grass on the 1st of June. High wind on the 4th; T on 7th, 8th, and 11th; H on 7th and 11th.

BRIDPORT.—The first three weeks of the month were rough and stormy; on the 11th storms of sleet and in the neighbourhood heavy snow fall. On the 20th severe T S, in the neighbourhood of Litton, about six miles from here; several sheep were killed by the L, trees torn down, Blagdon monument struck and five men seriously injured. Sharp frost on the 19th, cutting the potatoes severely.

BODMIN.—Fine streamers of aurora radiating from the N. on the 9th. The month remarkable for its cold, ungenial weather, temp. 1°·5 below the average.

CIRENCESTER.—On May 11th a considerable fall of S in the morning and again in the afternoon, when at 3.30 the darkness was so great that gas was required to enable one to read.

HAUGHTON HALL.—Up to the 12th R daily, from which time frequently, but farmers able to get in their swedes and mangold wurzel seed. Sharp frosts on 19th and 20th, damaging greatly early potatoes and apple blossoms, even the oak leaves cut on low grounds. The high temp. with which the month opened sank to 52° on the 8th, on which day vast cumuli clouds with T and H, slight S on 11th, T and H again on 22nd and 31st. Oaks in full leaf on 29th, but the ash late, many not bursting; pastures most luxuriant; orange-tipped butterfly on 1st; house martin seen on 6th, turtle dove appeared on 9th, fly-catcher first seen on 25th. Lilacs in blossom on 2nd, lily of the valley in flower on 4th, hawthorn in blossom on 15th.

ORLETON.—A cloudy, cold ungenial month, with the exception of a few fine warm days at the beginning and end of the month. Mean temp. 2° below the average. Severe frost on the morning of 19th, which cut down the young ash, potatoes, and other tender plants. S on the 11th, H frequent, T on 7th, 8th, 15th, 21st, 22nd, and 23rd, but always distant.

KILLINGHOLME.—A cold month, grass very abundant, wheat not likely to be a heavy crop, oats and barley more promising; T S on 7th, with H, and again on the 8th, when a man and horse were killed by the L near Grimsby.

DERBY.—A cold ungenial month, the mean temp. being 2° below the average of seven years, two or three frosts in the country doing damage to the fruit trees and potatoes.

YORK.—High wind on 4th, mock sun on 5th and 6th, solar halo on 6th, Aurora on 7th, T on 8th, H on 10th.

ARNCLIFFE.—Wind chiefly W. and N.W., but very cold, very high on 13th; ther. on grass on night of 21st, 24°.

NORTH SHIELDS.—H on 11th, and with S on 17th and 19th, T S on 22nd, and T on 23rd.

SEATHWAITE.—S on tops of hills on 4th, 7th, 8th, 11th, and 22nd; H showers on 5th and 30th. The total rainfall exactly the average.

WALES.

HAVERFORDWEST.—A cold ungenial month, March-like in character, at times very cold and stormy, morning and evening very cold; there could scarcely be one day called a summer day. Vegetation backward. The 20th of May (Whit Monday) will long be remembered for its wintry character; the day opened cloudy and dark, with wind in fitful gusts from S.E., accompanied by clouds of dust; cold rain commenced at noon, wind increasing to a gale, afternoon very wet and stormy, it cleared a little about 4 p.m., at 6 p.m. the sky became very dark and presently a fearful storm of T, L and H, the L very vivid and forked; hail mingled with sleet, lay 3 inches deep on the ground; hail as large as marbles and the gusts of wind violent. About 9 miles from here, at a place called Brawdy, the L struck a thorn bush, splitting it and scorching the branches, passed through the hedge and crossing the road tore through the opposite hedge, dislodging the earth and stones, ran along the field, burning the grass, and finally killed a fine sheep. Three miles from thence, in a direction N.E., at a place called Carvoriog, the L struck a man sitting on his cart and killed him instantly; the direction of the storm was from N.W. to S.E.

SCOTLAND.

DUMFRIES.—The first three weeks were rainy, cold, and ungenial for the season of the year, the close of the month fine; the temp. at night much the same as last year, but during the day 6°·5 lower; the season two or three weeks later than last year, the country is however fresh and very beautiful. T on 9th and 15th, H on 19th, 22nd, and 23rd; S on 11th and 19th. Hawthorn in bloom on 18th.

SILVERBUT HALL, HAWICK.—A wet and very cold month; N.E. winds most prevalent; hills white with snow on 11th, S and H showers on 8th, 9th, 11th, 17th, 19th, 20th, and 29th. T on 8th, 9th, and 30th. Landrail first heard on 24th. The gooseberry catterpillar has not yet appeared on the bushes.

AUCHENDRANE, AYR.—This month the mean bar. pressure, mean temp., elastic force of vapour, force of wind and evaporation, were all *below* our May means, the difference also between the mean temp. of air and that of dew point was less, and the air more humid; on the other hand, the bar. range, rainfall, and amount of cloud were all *below* [above ?—ED.] the May mean. Thus May has been here a cold rainy month, and although the night temp. of the two weeks, 12th to 25th, was very low, there were no severe frosts to injure the fruit trees, and notwithstanding the great rainfall moderate winds, cloudy sky, and weak evaporation, the rivers have fallen rather low, owing, no doubt, to the enormous consumption of water by the vegetable kingdom at this season of the year. Crops continued to look well. No T S occurred during the month.

CASTLE TOWARD.—Nearly 2·00 in. more rain fell during May than in April, and ·40 in. more than average, but little sunshine, with cold piercing wind; the month was generally dull, cold, and damp, prevailing winds N.W. and W.; max. temp. 58° on the 28th, min. temp. 32°·0. Crops look well, as do the fruit trees. On the whole it has been a good favourable month for out-door work.

NOOKTON.—T at 3 p.m. on 8th, and again on 9th, at the same time. H on 8th and 11th, S on 9th and 10th.

DEANSTON.—General character of this May, cold, rainy (with H showers), and backward, about 4° colder than in May, 1870. Severe frosts at night; potatoes blackened on 19th and 21st. T S on 8th and 22nd.

LOGIERAIT.—From the 15th, cold and ungenial, with E. winds prevailing; temp. low, and vegetation backward. Ther. at or below 34° on nine nights.

ABERDEEN.—A month of wet, dull, raw, unseasonable weather, winds generally light, but those from S.W., N.W. and N. more frequent than usual. On the 14th, at 5 a.m., a severe T S, and H storm between 1 and 2 p.m.; fields quite white with hailstones from a quarter to half-an-inch in diameter; ground white with snow at 8 a.m., on 10th, heavy hail on 31st.

PORTREE.—The coldest May on record; ground covered with S from 17th to 23rd; ice on morning of 19th three-eighths of an inch thick; a tremendous shower of very large H from 1.40 p.m. (on 23rd) till 2.10 p.m., being preceded by an awful noise something like the blowing off of steam from a strong boiler. A heavy gale all day on 17th from the N., and another on 29th from S., continuing from 12.0 p.m. to 4.0 a.m. The frost has nipped all vegetation, and the weather continues cold.

LOCHBROOM.—This has been a remarkably cold month, especially as compared with the warmth of the three previous months; there were only six dry days, and most of the rainy ones had H and S, and piercing winds from N. and E.

SANDWICK.—Northerly winds from 4th till 23rd, but since then the weather has been mild and pleasant. A little H at noon, and a red sun pillar at sunset on 10th. Aurora at 1 a.m. on 11th.

IRELAND.

WATERFORD.—Owing to the prevalence of N. and N.E. winds during the month the weather has been very cold; it was N. or N.E. on twenty-one days, and N.W. on seven days.

MONKSTOWN.—A cold drizzly month, N.W., N. or N.E. winds prevailing for three weeks, and the temp. low; heavy H on 9th.

GALWAY.—H R S and T from 1.15 p.m. to 2.20 p.m. on 19th. H on 21st.

DOO CASTLE.—This month has been remarkably cold for the season, the wind blowing from N. or N.E., as a consequence there has been little vegetation of any kind, grass almost disappearing off the pasture land; potatoes injured by frost of 12th.

WARINGSTOWN.—The wind varied from E. to W. of N. for twenty-six days this month, with cold showers on most days. Altogether this has been the coldest month of May I ever remember.

LECKPATRICK.—Rainfall 0·10 above the average of the last ten years.

ON THE SPRING OF 1872.

To the Editor of the Meteorological Magazine.

SIR,—With the exception of 1869, when the rainfall of the first five months was 14·21 in., that of the present season, 13·85 in., is the wettest I have on record for 18 years for the like period, that of 1860 was, however, 13·84 in. The past May was the wettest I have registered for that month, and also the coldest, for apart from the four days' frost reported in the table, there were several occasions when slight frosts were visible in certain places, even as late as the 1st of June, while the ice on the morning of May 12th was so thick as to allow a basin that I had put outside half full of water to be turned upside down without the water escaping, the thermometer denoting 29°, not near so low as is reported from many other places, but as it continued at that point for so many hours, the ice was formed as stated. Taken as a whole, May will be long remembered as a disastrous month to the fruit grower.

J. ROBSON.

Linton Park, Maidstone, June 2nd, 1872.